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The Impact of Minimum Wages on Job Training: An Empirical Exploration with Establishment Data*

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Abstract

Using data from the National Employer Survey (NES), this study examines the relationship between wages and on-the-job training. Traditional theory argues that workers may finance on-the-job human capital accumulation through lower wages. A binding minimum wage may, therefore, reduce workplace training if it prevents low-wage workers from offering wage cuts to help finance training. Empirical findings in this area have failed to reach a consensus on the training effects of minimum wages. However, previous research has relied primarily on survey data from individual workers, which typically possess poor measures of job training and little information about the characteristics of firms. Unlike previous research, this study addresses the issue of minimum wages and on-the-job training with a unique employer survey. We find strong evidence to suggest that minimum wages are associated with a reduction in the percentage of an establishment's workforce receiving training, but only weak evidence indicating that minimum wages reduce the average number of hours establishments devote to training activities.

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Introduction

If current proposals to boost the federal minimum wage to roughly $6.15 an hour are passed by Congress and signed by the President, the minimum wage will have risen by almost 50% within the span of less than a decade. Many policy makers appear to be at ease with the idea of using minimum wages as a tool to address problems of the working poor because of recent research suggesting that minimum wage increases have little if any impact on the employment of low-skill workers (Card and Krueger 1995). However, there are other areas of concern, in addition to employment loss, that deserve careful research attention before concluding that minimum wages are an effective policy tool to aid the working poor. One of these is the impact of minimum wages on job training, and thus on wage growth.

Human capital theory suggests that workers must contribute towards investments in job training, and that one way in which they might do so is through reduced wages (Becker 1964). However, to the extent workers contribute towards the cost of job training by accepting lower wages, minimum wage laws may prevent this type of contribution and thereby reduce on-the-job human capital formation (Rosen 1972). Existing empirical studies of the relationship between minimum wages and job training yield divergent results. Most of these studies utilize worker survey data and focus on the job training impact of minimum wages among a subset of workers. Most of them also lack detailed measures of job training or establishment-level variables that are important determinants of training.

In this paper, we overcome these various impediments by using an establishment data set that possesses good measures of job training, good establishment-level control variables, and that allows us to focus on the impact of minimum wages on the establishment work force as a whole. The decision to offer training is ultimately made by the firm. Even if workers pay for some or all

of their training through lower wages, their decision to undertake training is largely made by the choice of which firm to join. Thus, the firm is the logical unit of analysis for exploring the issue of job training and minimum wages.

In the first section of the paper, we briefly review the empirical literature on the impact of minimum wages on job training. The second and third sections discuss the empirical specification and data to be used in the present analysis. The fourth section discusses the empirical results. We find strong evidence that minimum wages reduce the percentage of the establishment workforce receiving training, but only weak evidence that they reduce the hours of training received by a typical worker.

Review of the Literature

The empirical literature on the impact of minimum wages on job training is not voluminous. The earliest efforts focussed primarily on wage growth as a proxy for training, and the results were mixed. In two studies, age-earnings profiles were significantly flatter among workers whose wages were bound to the minimum (Leighton and Mincer 1981; Hashimoto 1982), while a third study (Lazear and Miller 1981) found no statistically significant relationship between the bindingness of the minimum wage and the slope of age-earnings profiles. Recent evidence has cast serious doubt on the validity of this approach.

Grossberg and Sicilian (1999) find that while minimum wages are indeed associated with reduced wage growth, they appear to have no significant impact on job training. Acemoglu and Pischke (1999) offer an insightful interpretation of these results. They claim that minimum wages eliminate part of the lower tail of the wage distribution, bunching workers around the wage minimum and thereby lowering the age-earnings profile, and that this will be true independent of

their impact on training. Thus, it seems clear that future tests of the relationship between minimum wages and job training must be conducted with information on worker training.

There are five studies that offer evidence on the impact of minimum wages directly on job training. The basic approach is to regress a measure of job training on the degree to which the minimum wage is binding, the hypothesis being that the more binding the minimum wage the less job training the worker and firm will undertake. There exist two levels of analysis – one operating at the state or region level and the other operating at the level of the individual worker. Both contain important drawbacks.

Leighton and Mincer (1981) and Neumark and Wascher (1998) exploit variation in state minimums to explore the relationship between minimum wages and training. Both use data on individual workers, but their measures of the bindingness of wage minimums exist at the state level. For example, Neumark and Wascher measure the extent to which the state minimum wage exceeded the federal minimum over the previous three years. The results of both studies suggest that the more binding the minimum wage, the less likely a worker will receive on-the-job training.

However, there is an econometric problem that plagues studies using more aggregate measures of minimum wage bindingness with worker level data. Because the right-hand-side minimum wage variable is at a higher level of aggregation than the unit of observation, the estimated standard errors may understate the inaccuracy of the estimators (Moulton 1986), thereby leading the researcher to perhaps mistakenly conclude that minimum wages reduce training when in fact they do not. Acemoglu and Pischke (1999) conduct a similar type of analysis, utilizing instead a regional measure of bindingness, in which they correct for this problem in the standard errors of estimates. They find little evidence for a minimum wage impact on training in their results.

A second level at which the analysis of this question has been conducted is at the individual worker level. Schiller (1994) and Grossberg and Sicilian (1999) adopt measures of minimum wage bindingness that vary at the level of the individual worker. Grossberg and Sicilian, for example, compare the impact on training of workers who are paid the minimum wage with those who earn both below the minimum and slightly more than the minimum. Schiller finds evidence that minimum wages reduce training, while Grossberg and Sicilian do not.

The problem with measures of minimum wage bindingness that vary at the level of the individual worker is that omitted determinants of training are also in many cases likely to be correlated with the wage, and therefore with the minimum wage bindingness measure. The estimated impact of minimum wages on training may well be biased as a result, the nature of the bias depending on the exact specification employed.

Two of the most obvious examples of such bias in estimates of the minimum wage impact on training result from the absence of controls for worker turnover and the endogeneity of the wage component of the bindingness measure. Efficiency wage theory suggests that high wages – which implies less bindingness with wage minimums – may be paid by firms as a way of reducing costly turnover (Akerlof and Yellen 1986). Turnover reduction, on the other hand, may be a prerequisite for on-the-job training (Prendergast 1993). Indeed, there is empirical evidence to suggest that the extent of training is both dependent upon and an important determinant of the rate of labor turnover (Royalty 1996). If turnover is related both to training and to the degree to which the wage exceeds the mandated minimum in the way we have claimed, the failure to control for turnover may bias upward the estimated impact of minimum wages on training. None of the studies of the impact of minimum wages on training have adequately controlled for labor turnover.

While it is possible that binding minimum wages reduce training, it is most probable that training raises wages and thereby makes wages less bound to minimum wage standards. The wage component of the minimum wage bindingness measure is therefore likely to be correlated with left-out determinants of training, biasing the estimated impact of minimum wages on training. And, once again, the bias is likely to be upward.[1]

Acemoglu and Pischke conduct a first-difference analysis of the individual worker training equation using panel data. Fixed components of the error term will be eliminated in this approach, thereby reducing the possible bias found in cross-sectional levels regressions. Acemoglu and Pischke find no evidence of a training effect of minimum wages in their results. However, their measure of on-the-job training is a particularly blunt one – the change in whether or not the worker received training.

Indeed, poor measures of training plague this literature more generally. The more careful studies in the literature employ as a measure of job training the dichotomous variable "whether or not a worker received training on the job" (Neumark and Wascher 1998; Acemoglu and Pischke 1999). An important exception is the Grossberg and Sicilian (1999) study, which utilizes data from establishments. The job training information they use refers to the amount of job training given to the last-hired worker. Specifically, their training measure is the number of hours devoted to training over the first three months of tenure of the most recently hired worker. Grossberg and Sicilian do not, however, account for labor turnover or many other important establishment-level variables.

In the present paper, we utilize a unique data set on establishments that offers a number of improvements over the data used in the existing literature. First, we have very good measures of

[1] The Grossberg and Sicilian results are not subject to this type of bias because they use the starting wage of the

training – the percentage of the work force receiving training and the average hours of training. Second, we possess good measures of a number of establishment-level control variables, such as turnover and fringe benefits, that are absent from most existing studies.

We feel that using establishment data, and the establishment as the unit of analysis, has a number of additional benefits besides perhaps providing us with better measures of training and turnover. Economies of scale in training and a host of other considerations suggest to us that job training is likely to exist as a matter of policy at the establishment or firm level. Workers receive training by virtue of the firm to which they are attached. Focussing on the determinants of training from the worker's point of view might make sense in a world of costless mobility, where the public-good nature of training poses no real problem for individual choice (Tiebout 1956). But, the very mention of job training typically suggests a context in which there is greater attachment between worker and firm than ideal microeconomics models posit.

Moreover, focussing on the establishment draws our attention away from the impact of minimum wages on individual groups of workers and towards their impact on the establishment workforce as a whole. This may be viewed by some as a criticism of our analysis, but we do not view it that way. Much of the existing literature identifies which group of workers is likely to be affected by minimum wages, a priori, and then focuses on this group only, sometimes in relation to other groups that are hypothesized, also in an a priori fashion, to be unaffected. But, in fact, designating groups of workers as "affected" and "unaffected" is often quite arbitrary. An establishment-level approach allows us to eschew this kind of a priori arbitrariness.

Finally, although we are unable to isolate which types of workers are affected by minimum wages, we *are* able to shed light on the way in which minimum wages affect the workforce as a

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worker to construct their measure of minimum wage bindingness.

whole. In particular, we are able to say something about the form of the impact – whether minimum wages reduce training completely for an unidentifiable segment of the workforce and whether average hours decline. Depending on the results, we also may be in a position to say something about whether the reduction in training for one segment of the workforce is compensated for by increased training of another segment. These are largely unexplored issues in the literature on minimum wage effects on job training. Moreover, because existing studies typically analyze different segments of the labor force, if there are both positive and negative effects of minimum wages on training for different groups of workers, it is not surprising to find divergent results.

Econometric Specification

The empirical approach we take resembles the analysis that exists in the recent literature, but with establishment-level data that contain improved measures of job training. In particular, we regress the percent of workers trained and the average number of hours spent on training activities on a set of establishment characteristics and a measure of the "bindingness" of the minimum wage. One specification of the training equation is thus

$$T_{js} = a + bX_j + d\hat{R}_{js} + y M_s + e_{js} \qquad (1)$$

$$R_{js} = g + fX_j + hM_s + qZ_j + n_{js} \qquad (2)$$

where the *j* and *s* subscripts denote establishment and state, respectively; *T* is the measure of training; *X* is a set of establishment characteristics (e.g., industry, size, percent of female workers, percent of workers with a high school diploma, etc.); *M* is the minimum wage bindingness measure; *R* is the turnover rate; and *Z* is a vector of instruments (i.e., "percent of non-supervisors unionized" and the "average number of weeks it takes to fill a position") that are uncorrelated with e_{js}.

The minimum wage measure introduced at this stage of the analysis is similar to that used by Neumark and Wascher (1998). It captures the "bindingness" of the minimum wage at the state level by identifying states with minimum wages above the federal minimum and assigning each establishment in those states the value of the difference in the minimums if the state minimum is greater than the federal minimum, and zero otherwise. There is, however, an econometric problem with both this approach and those making use of regional or state-level minimum wage measures. Since the minimum wage variable in (1) is at a higher level of aggregation than the unit of observation, the standard errors of the estimates may be biased downward, thereby allowing one to mistakenly find in favor of statistical significance (Moulton 1986). The standard OLS assumption of uncorrelated errors between the units of observation will be violated, and instead the error structure will have the following form

$$e_{js} = l_s + j_{js} \qquad (3)$$

where l represents the component of the error that is common to all establishments in a given state.

To the extent that wages vary considerably within relatively small geographic boundaries, state-level controls may not accurately reflect the "bindingness" of the minimum wage for those workers (Acemoglu and Pischke 1999). For example, in a given state where the minimum wage exceeds the federal minimum, workers in high-wage areas will be less constrained than workers in low-wage areas. The same is true for workers in states where the minimum wage is set to the federal standard. The minimum wage variable in (1) is zero in all states where the minimum does not exceed the federal minimum, so workers in establishments across numerous states, with varying market wages are assumed to be equally bound by the minimum wage (in this case, not at all). Clearly, a better minimum wage measure is needed to determine the impact of minimum wages on training.

To avoid these problems, we construct an establishment-level minimum wage measure that captures the extent to which the average establishment wage exceeds the relevant minimum. Acemoglu and Pischke (1999) construct a similar variable that measures the ratio of the minimum wage to the average wage in the MSA (Metropolitan Statistical Area). This is a better measure of the bindingness of the minimum wage, but since wages vary considerably within MSAs, even less aggregation may be more appropriate. The ideal measure might capture the bindingness of the minimum wage for a particular worker. In our analysis, the unit of observation is an establishment, so we construct a minimum wage measure that captures the average degree of bindingness faced by workers at their place of employment. Consequently, our minimum wage variable is the ratio of the applicable minimum wage to the average wage in an establishment.

This approach mitigates the problem of the standard errors overstating the precision of the estimated coefficients, but it also raises the possibility that estimated coefficients will suffer from endogeneity bias. While job training may be a function of the extent to which average wages

exceed the stipulated minimum wage, it is also true that wages depend on training. Thus, left out determinants of training are likely to be correlated with the establishment average wage component of the minimum wage bindingness measure. We correct for this by instrumenting this minimum wage variable with "percent of non-supervisors unionized" and the "natural log of total sales" as identifying variables. In this specification, turnover is also instrumented as in (1) and (2) above. This satisfies the over-identifying restrictions and allows us to perform generalized method of moments (GMM) specification tests (Hausman 1978; Newey 1985).

Data

This study uses the 1997 National Employer Survey (NES), which is supplemented with Standard Statistical Establishment List (SSEL) data.[2] This version of the NES contains establishment location information that is used to examine covariation between minimum wages and on-the-job training (Table 1 displays the minimum wage in cases where the state minimum exceeded the federal minimum). Geographical location information is obtained from the SSEL by linking each establishment to their Census File Number (CFN). The SSEL is the Census Bureau's master list of all establishments and enterprises in the United States. It provides the sampling frame for all of the Census Bureau's economic censuses (conducted quinquenially in years ending with 2 and 7) and surveys, including the NES. The 1995 SSEL serves as the sampling frame for the 1997 NES.

[2] This data is confidential under Title 13 and 26, United States Code. Access was obtained through the Center for Economic Studies (CES) while employed as a researcher for the Longitudinal Employer Household Dynamics (LEHD) project at the U.S. Census Bureau. Researchers can access this version of the NES only with a CES-approved proposal (see http://www.ces.census.gov/ces.php/home). A public-use version of the data is available at http://www.irhe.upenn.edu/research/research-main.html

Survey data was collected with a computer-assisted telephone interview (CATI). The sample was evenly divided between manufacturers and non-manufacturers, with explicit over-sampling of establishments that have 100 or more employees and implicit over-sampling of manufacturers because they are greatly outnumbered by non-manufacturers in the SSEL universe. Establishments in California, Kentucky, Maryland, Michigan, and Pennsylvania were also over-sampled in order to support in depth analysis of school reforms of interest to the survey sponsors (the National Center for Postsecondary Improvement, the Consortium for Policy Research in Education, and the National School-to-Work Office).

The survey was administered by the U.S. Census Bureau in the summer of 1997, and asked establishments about conditions in 1996.[3] It represents the responses of approximately 5,400 establishments for a 78 percent overall response rate. This is higher than the response rate for other establishment surveys, but similar to those of the 1994 NES (Lynch and Black 1998). The presence of over-sampled establishments requires the use of the provided weights in order to produce representative statistics and parameter estimates. In addition, 24 percent of establishments that responded only partially completed the CATI questionnaire. Therefore, the results presented in the following sections refer to the set of establishments for which information was available. Table 2 provides descriptive statistics for these cases.

The availability of geographic information from the SSEL allows us to address our research objectives and use the excellent measures of establishment-level training contained in the NES. While many previous studies have had to rely on dichotomous measures of training (i.e., the individual did or did not receive training), we are able to construct a variety of training measures including the percent of workers trained and the average number of hours devoted to

training in an establishment. Furthermore, the data set contains measures of labor turnover and a host of other variables that affect the firm's decision to offer training. Some, such as the gender and racial composition and average level of schooling of the workforce, mirror the kinds of variables one finds in estimated training regressions using individual-level survey data. Others, such as the quality of the local high school, are important worker-related determinants of job training that are rarely captured in household survey data. And still others, such as whether the establishment has recently increased employment or is experimenting with new forms of workplace organization (e.g., self-managed teams or job rotation), are establishment-level variables that clearly impact training, but are virtually impossible to obtain from household survey data.

Results

In Table 3, column 1 we present the results of the "percent trained" regression using state-level variation in the minimum wage bindingness measure. The results suggest that establishments in states with minimum wages that exceed the federal minimum train a smaller percentage of their workforce, and that the percentage trained falls as the difference between the state and federal minimums rises. For example, states with a minimum wage that is fifty cents above the federal minimum possess establishments that train roughly half the percentage of the workforce that is average for the entire regression sample. Minimum wages have a sizeable effect on the percentage of an establishment's workforce that is trained.

Some of the other estimated coefficients from this regression are also interesting. The results suggest, for example, that medium size establishments, establishments with low turnover

[3] In October 1996 the federal minimum wage increased from $4.25 to $4.75, so we assign a weighted average to

rates, and establishments with more educated workers train a larger percentage of their labor force. The percentage of workers trained is also larger if the quality of high school graduates is either unacceptable or outstanding rather than being merely acceptable.

The finding that high turnover is associated with less training is consistent with other findings in the literature on training (e.g., Royalty). The results on the quality of the local high school suggest that firms may need to engage in blanket remedial training when the local high school is unacceptable, but may take the opportunity to invest broadly in skills acquisition when the local high school produces outstanding graduates.

Two of the results from the "percent trained" regression are particularly interesting, both because they are surprising and because they shed light on the extent of job training in establishments operating under the newest workplace arrangements. The growth of both temporary workers and work teams is well documented in the literature (e.g., Golden and Appelbaum 1992; Osterman 1994a, 1994b). Our results suggest that the greater use of temporary workers and the pervasiveness of work teams increase the percentage of workers who receive training.

The interpretation of these findings is not straightforward. One plausible explanation of the former result is the following. Suppose temporary workers are not considered part of an establishment's current workforce, and yet are essentially replacements for formerly in-house workers who typically received no training in that capacity. In this case, the finding that a larger percentage of the current workforce (which excludes the temporary workers) receives training in establishments utilizing temporary workers may reflect no real change in the extent of training. However, the training associated with high-performance workplaces, which utilize work teams

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represent the minimum wage for that year.

and sophisticated systems of quality control and the newest technology, is probably truly reaching a larger percentage of the plant's workforce.

In column 2 of Table 3, we present the results for the "average hours of training" regression. The minimum wage difference variable is statistically significant and quantitatively sizeable in this estimated equation as well. Establishments in states with a state minimum that exceeds the federal minimum by fifty cents possess ten fewer hours of training per worker, which is roughly 80 percent of the mean of average hours for the regression sample.

A number of results are consistent across the "percent trained" and "average hours" regressions. For example, both the temporary workers and work teams variables affect the percentage of the labor force that is trained as well as the average hours of training. And medium size firms devote, on average, a larger number of average hours to training a larger percentage of their workforces.

Some variables become statistically significant in the "average hours" equation that were not significant in the "percent trained" equation. For example, those establishments witnessing increased employment possess greater average hours of training – presumably reflecting the need to devote greater training resources to newer workers – but the percentage of their labor forces receiving training is no different from other firms, *ceteris paribus*.

The differences in results across the two equations are interesting because they shed light on the joint impact of covariates on "percent trained" and "average hours." For example, establishments with high labor turnover appear to train a smaller percentage of their labor forces, but the hours they devote to training are apparently no different on average. Thus, high turnover firms devote the same hours to training as do low turnover firms, but they focus their training resources on a smaller, presumably more stable percentage of the workforce.

Establishments with a more highly educated labor force train a larger percentage of their workers, but their hours of training are, on average, no different from establishments with less-educated workers. Establishments hiring high school graduates from either barely acceptable quality high schools or truly superior quality high schools train a larger percentage of their workers than do establishments in communities where the quality of training at the local high school is totally unacceptable or only acceptable. But the establishments with acceptable quality high school graduates are the ones that devote the largest number of hours to training on average.

The results in Table 3 suggest that minimum wages lower both the percentage of an establishment's workforce receiving training as well as the average hours devoted to training workers. However, these results come from regressions in which the measure of minimum wage bindingness varies at the state level only. Under these circumstances, the standard errors of estimates may understate the true error around the estimated coefficients, leading us to perhaps erroneously conclude that minimum wages reduce training when in fact they do not. We now turn to an analysis of similar specifications of the training equations but with measures of bindingness that vary at the establishment level, and which therefore do not possess this problem.

The results in column 1 of Table 4 are consistent with the earlier findings, which suggest that minimum wages reduce the percentage of the establishment labor force receiving training. The relative minimum wage variable is negative and statistically as well as quantitatively significant. A fifty cent increase in the mean minimum wage decreases the percentage of the labor force receiving training by roughly 6.5 percentage points, or roughly 23 percent of the mean percentage of workers trained.

With some important exceptions, the other findings are also basically similar to those found in the previous analysis. For example, the use of temporary workers and teams in

production raises the percentage of the labor force receiving training. Establishments with a more educated labor force train a larger percentage of workers (although the result for the percentage of college graduates is no longer statistically significant).

There are, however, a number of interesting differences between these and the previous results. Turnover is no longer negative and statistically significantly related to training. The percentage of female workers is positively and significantly associated with the percentage of workers trained, whereas it was not statistically different from zero in the previous findings. The percentage of the labor force trained rises steadily with both the size of the establishment and the quality of the local high school, whereas before it did not. The percentage of part-time workers among the work force is now negatively related to training, whereas before it was not statistically significantly different from zero.

The difference in results across the two analyses is related to the fact that the average establishment wage now appears on the right-hand-side of the training equation. There are a variety of reasons for including the wage in an estimated training equation. For example, the wage is an important indicator of the costs of training in that it captures the value of lost production during periods when workers are learning but not producing. Larger firms may train a greater percentage of their workers, but they also typically have higher wages and therefore higher costs of training. Thus, the negative relationship between large firms and training found in the previous analysis – which becomes positive and statistically significant in the current findings – may be due to left-out variable bias.

However, not all of the differences in results can be interpreted by conceiving of the wage as a left-out measure of training costs. The relationship between training and turnover, for example, goes from negative and statistically significant in the previous findings to positive and

insignificant in the current results. High turnover is typically thought to be associated with low wages, and thus low costs of training. Introducing the average establishment wage into the estimated equation should therefore strengthen the negative relationship between turnover and training, not make it weaker. Our interpretation of the differences in these results is as follows. The negative effect of turnover on training comes entirely from wage effects: high wages reduce turnover and therefore provide an environment in which training is profitable for workers and firm. Average wages held constant, however, the greater the turnover, the more training the firm will be required to undertake among replacement workers.

In the last column of Table 4, we present the results for the "average hours of training" regression. The results suggest that the degree of bindingness of minimum wages has no statistically significant effect on the average hours devoted to training. This result contradicts our findings from the previous analysis. But, recall that the standard error of the estimate is likely to be understated in the previous findings. Moreover, the level of statistical significance on the bindingness measure in those results was not extraordinarily high; a 35 percent increase in the standard error, for example, would render the bindingness measure statistically insignificant at the .01 level in this equation.

Comparing the results of the "average hours" equation with those of the "percent trained" equation, we find that involvement in work teams is positively associated with both the intensity and average pervasiveness of training among the work force. While establishment size is positively associated with "percent trained," it is only medium size establishments that devote more hours per worker to training. Similarly, while the quality of the local high school is positively associated with the pervasiveness of training among the work force, it is only when the quality is just acceptable that more training per worker takes place.

Perhaps the most interesting contrast between the first and second columns of results in Table 4 regards the relative unimportance of part-time workers, temporary workers, and the percentage of women in the work force in the estimated "average hours" equation. These three features of an establishment's labor force are important determinants of the pervasiveness of training, but do not appear to affect the intensity with which the average worker is trained.

Conclusions

This study utilizes establishment data to explore the impact of minimum wages on job training. There are several advantages to using establishment data, including better measures of job training and good establishment-level control variables. We find strong evidence to suggest that minimum wages reduce the percentage of an establishment's labor force that receives training. This is consistent with both theory and previous empirical findings suggesting that, by restricting the ability of employees to contribute to training through foregone earnings, minimum wages reduce the job training received by some workers. Interestingly, however, we find much weaker evidence to suggest that the average hours of training undertaken by the work force as a whole is affected by minimum wages.

If, as recent evidence suggests (Card and Krueger 1995), there are virtually no negative employment effects of minimum wages, these results indicate that some members of the work force lose the opportunity to undertake training, but that others may be recipients of increased hours of training as a result of minimum wages. While a substitution effect on job training such as this is not inconsistent with human capital theory, especially if minimum wages alter job descriptions within the establishment, it has never been the topic of serious empirical investigation.

The possibility that minimum wages initiate a substitution in training among the work force clearly warrants further investigation. It suggests that minimum wages have a more complicated impact on job training than previously thought, and offers a possible resolution to the divergent results found heretofore in the empirical literature on minimum wages and training. The observed impact of minimum wages on training using worker survey data will depend crucially on the sample of workers analyzed. The impact can be negative, nonexistent, or even positive depending on which segments of the workforce are chosen for analysis.

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TABLE 1

States with Minimum Wages that Exceeded the Federal Minimum Wage

	Minimum Wage in 1996	Weighted Gap
Federal	4.25/4.75	
Alaska	4.75	0.375
Connecticut	4.27	0.000
Delaware	4.65	0.275
District of Columbia	5.25	0.875
Hawaii	5.25	0.875
Iowa	4.65	0.275
New Jersey	5.05	0.675
Oregon	4.75	0.375
Rhode Island	4.45	0.075
Vermont	4.75	0.375
Washington	4.90	0.525

Note – In 1996, the federal minimum wage was not implemented until October 1. All other minimum wages were implemented at the beginning of the calendar year. The minimum wage gaps are calculated using a weighted average of the federal minimum wage (i.e., $4.375).

TABLE 2

Variable Definitions and Descriptive Statistics

Variable	Mean	Std. Dev.
Training:		
percent of workers receiving training	45.1935	39.5869
average number of hours trained	22.2390	41.4760
Employment and Sales:		
50-99 employees	0.1592	0.3659
100-249 employees	0.1973	0.3980
250-999 employees	0.3003	0.4584
1,000 or more employees	0.1416	0.3487
multiple establishment firm	0.6809	0.4662
employment increased in past 3 years	0.3364	0.4725
employment decreased in past 3 years	0.1721	0.3775
turnover rate	21.8764	27.6819
average number of weeks to fill a position	3.2165	3.1936
natural log of total sales	17.0026	1.9060
Region:		
establishment located in west	0.1705	0.3761
establishment located in Midwest	0.2785	0.4483
establishment located in south	0.3682	0.4824
Workforce Characteristics:		
percent 18+ with a high school diploma	30.6877	6.5910
percent 18+ with a bachelors degree	12.8352	5.0352
number of permanent part-time workers	27.2249	164.5741
number of temporary workers	17.2320	105.6286
percent of female workers	39.9133	26.4279
percent of minority workers	26.3487	25.7982
percent of front-line workers	57.9482	28.1885
percent of support staff workers	13.0862	14.5637
percent of technician workers	8.9134	14.9346
percent of supervisory workers	6.7866	6.2718
percent of non-supervisors unionized	20.6195	36.5418
quality of local high school unacceptable	0.0230	0.1500
quality of local high school barely acceptable	0.1131	0.3168
quality of local high school acceptable	0.4117	0.4922
quality of local high school more than adequate	0.1100	0.3129
quality of local high school outstanding	0.0106	0.1024
Workplace Organization:		
percent of non-management in self-managed teams	16.1401	29.8220
percent of non-supervisors in job rotation	20.3863	31.3951
Compensation and Benefits:		
average hourly wage	13.9887	4.5018
estab contributes to pension or severance	0.8123	0.3905
estab contributes to medical or dental	0.9759	0.1533
estab contributes to child care or family leave	0.7042	0.4565
estab contributes to life insurance	0.9105	0.2855
estab contributes to sick pay or vacation	0.9862	0.1167
Minimum Wage:		
state min wage minus federal min wage	0.0323	0.1330
state min wage/average hourly wage	0.3447	0.1031

Note - These calculations are based on the sample of non-missing data for each respective variable and may not equal the regression means.

TABLE 3

Estimated Effects of Minimum Wages on Training using the State-Level Binding Measure

	(1)		(2)	
Explanatory Variable:	Est	Std Err	Est	Std Err
Employment:				
50-99 employees	4.2813**	1.7657	-0.0635	1.9251
100-249 employees	17.5320***	2.7425	2.3644	3.0506
250-999 employees	18.8961***	3.2316	14.3254***	3.5041
1,000 or more employees	-3.9268	5.9906	-7.2247	6.1419
multiple establishment firm	5.1546***	1.5521	-0.0566	1.7447
employment increased in past 3 years	1.0302	1.7415	4.6093**	1.9158
employment decreased in past 3 years	-2.4781	2.1952	-0.4409	2.4514
turnover rate (predicted)	-0.3872*	0.2052	-0.0880	0.2235
Region:				
establishment located in west	19.5587***	2.7323	10.2974***	3.1021
establishment located in Midwest	-2.2144	2.4544	-2.0502	2.8762
establishment located in south	0.2893	3.0796	-1.5105	3.4967
Workforce Characteristics:				
percent 18+ with a high school diploma	0.9805***	0.2755	0.3687	0.3056
percent 18+ with a bachelors degree	1.0164***	0.3046	0.0498	0.3332
number of permanent part-time workers	-0.0099	0.0062	0.0042	0.0062
number of temporary workers	0.0893***	0.0141	0.0572**	0.0259
percent of female workers	-0.0197	0.0386	0.0499	0.0419
percent of minority workers	-0.0220	0.0431	-0.0225	0.0469
percent of front-line workers	0.1241*	0.0641	0.1235*	0.0695
percent of support staff workers	0.0237	0.0977	0.0440	0.1057
percent of technician workers	0.7361***	0.0840	0.5815***	0.0920
percent of supervisory workers	0.8308***	0.1567	0.9850***	0.1705
quality of local high school unacceptable	26.0814***	4.6796	7.5308	5.4073
quality of local high school barely acceptable	12.7987***	3.7032	7.7260*	4.2964
quality of local high school acceptable	6.4091**	2.3261	9.3639***	2.7314
quality of local high school more than adequate	14.7484***	3.2620	3.0999	3.7271
quality of local high school outstanding	22.3004***	7.3722	-0.2268	9.6633
Workplace Organization:				
percent of non-management in self-managed teams	0.1618***	0.0232	0.1507***	0.0267
percent of non-supervisors in job rotation	-0.0063	0.0273	-0.0438	0.0300
Benefits:				
estab contributes to pension or severance	2.4007	2.1041	0.0480	2.2861
estab contributes to medical or dental	-7.5311**	3.4768	-5.3453	3.8788
estab contributes to child care or family leave	5.9884***	1.5652	2.8097	1.7907
estab contributes to life insurance	14.3245***	2.3238	10.2742***	2.5714
estab contributes to sick pay or vacation	14.3174***	3.6574	9.2852**	3.7742
Minimum Wage:				
state min wage minus federal min wage	-32.4955***	5.3779	-20.7448***	6.0636
N	2,285		1,812	
Adjusted R^2	0.3598		0.1652	

* $p<.10$; ** $p<.05$; *** $p<.01$

Note – The dependent variable in (1) is the percent of workers trained and the dependent variable in (2) is the average number of hours spent on training activities. All equations include 20 industry dummies and are estimated with the percent of workers receiving training as the dependent variable. Samples are restricted to establishments reporting all of the necessary information. The average number of weeks to fill a position and the percent of non-supervisors unionized are instruments used to predict turnover. A GMM specification test validated the choice of instruments.

TABLE 4

Estimated Effects of Minimum Wages on Training using the Establishment-Level Binding Measure

	(1)		(2)	
Explanatory Variable:	Est	Std Err	Est	Std Err
Employment:				
50-99 employees	9.5452***	1.8976	0.9272	2.2272
100-249 employees	13.1367***	3.1577	1.2236	3.7040
250-999 employees	18.6436***	3.5861	18.3208***	4.1201
1,000 or more employees	29.6375***	8.1260	15.2605*	8.8947
multiple establishment firm	-3.2691*	1.9152	-3.3351	2.2771
employment increased in past 3 years	3.3199*	1.8328	6.6155***	2.1513
employment decreased in past 3 years	-1.1316	2.3228	-1.1075	2.7802
turnover rate (predicted)	0.3719	0.2587	0.1777	0.2954
Region:				
establishment located in west	30.4560***	2.9925	15.3037***	3.6906
establishment located in Midwest	2.4770	2.5556	0.6877	3.2156
establishment located in south	9.3449**	3.3583	0.9204	4.1060
Workforce Characteristics:				
percent 18+ with a high school diploma	1.2190***	0.2840	0.4048	0.3383
percent 18+ with a bachelors degree	0.4031	0.3521	-0.3478	0.4064
number of permanent part-time workers	-0.0190**	0.0068	-0.0047	0.0073
number of temporary workers	0.0920***	0.0144	0.0073	0.0288
percent of female workers	0.1677***	0.0507	0.0596	0.0586
percent of minority workers	-0.0372	0.0449	-0.0152	0.0520
percent of front-line workers	0.3247***	0.0785	0.2160**	0.0913
percent of support staff workers	0.3603***	0.1154	0.2046	0.1347
percent of technician workers	0.6568***	0.0912	0.5762***	0.1057
percent of supervisory workers	0.6009***	0.1791	1.1322***	0.2033
quality of local high school unacceptable	15.3576***	5.2213	9.9543	6.6081
quality of local high school barely acceptable	13.9492***	3.8989	5.7150	4.7461
quality of local high school acceptable	16.8657***	2.7422	11.5186***	3.2848
quality of local high school more than adequate	20.6616***	3.4248	3.0780	4.1150
quality of local high school outstanding	47.1828***	8.5608	0.0792	11.7865
Workplace Organization:				
percent of non-management in self-managed teams	0.1520***	0.0244	0.1558***	0.0299
percent of non-supervisors in job rotation	0.0018	0.0290	-0.0561	0.0343
Benefits:				
estab contributes to pension or severance	-8.1748**	2.8845	-0.8986	3.2853
estab contributes to medical or dental	-39.2167***	6.3809	-15.3130**	7.5315
estab contributes to child care or family leave	0.2072	1.8217	1.1626	2.2138
estab contributes to life insurance	20.0572***	2.4284	14.9651***	2.9106
estab contributes to sick pay or vacation	23.9454***	4.1103	13.6821***	4.5891
Minimum Wage:				
state min wage/average hourly wage (predicted)	-186.0728***	35.3858	-41.6702	40.3551
N	1,955		1,558	
Adjusted R^2	0.4013		0.1688	

* $p<.10$; ** $p<.05$; *** $p<.01$

Note - The dependent variable in (1) is the percent of workers trained and the dependent variable in (2) is the average number of hours spent on training activities. All equations include 20 industry dummies and are estimated with the average number of hours trained as the dependent variable. Samples are restricted to establishments reporting all of the necessary information. The average number of weeks to fill a position and the percent of non-supervisors unionized are instruments used to predict turnover. The natural log of total sales and the percent of non-supervisors unionized are instruments used to predict state min wage/average hourly wage. A GMM specification test validated the choice of instruments.